

December 1, 2015

Ms. Kyra Moore, Director
Air Pollution Control Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Re: Air Quality Modeling Analysis

Dear Ms. Moore:

On September 3, 2015, Ameren Missouri submitted comments in support of an SO₂ classification of "Unclassifiable" for the area around the Labadie Energy Center. As part of those comments, Ameren submitted an AERMOD modeling analysis using both default and beta options. EPA recently held a conference on Air Quality Modeling and public hearing wherein the use of various alternatives such as the use of "low-wind option" as an AERMOD default input. It is critical that the most accurate and appropriate modeling option be used as, depending on the AERMOD options chosen; the Franklin County area either demonstrates attainment or nonattainment with the SO₂ standard. Ameren Missouri has installed ambient SO₂ and meteorological monitoring sites in areas demonstrated, based on AERMOD modeling recommended by the Air Pollution Control Program, to be representative of areas of higher SO₂ concentrations. These sites have been operational since April of 2015 and to date measured air quality data reflects compliance with the SO₂ ambient standard.

Attached is a demonstration illustrating that the use of the AERMOD as proposed as default options at EPA's 11th conference on Air Quality Modeling are appropriate for this area.

Please contact me at your convenience if you have questions or if you need additional information.

Sincerely,



Steven C. Whitworth
Senior Director, Environmental Policy and Analysis

Attachments

Cc: Michael Jay – USEPA Region 7

Evaluations and Regulatory Acceptance of AERMOD Low Wind Speed Options

Robert Paine, AECOM

November 12, 2015

1. Introduction and Background

EPA is proposing¹ to adopt as default options the low wind speed improvements to AERMET (“ADJ_U*” option) and AERMOD (“LOWWIND3” option). As discussed below, these options improve model accuracy and are based on peer-reviewed studies as well as evaluations by EPA and other investigators.

In 2010, the results of an evaluation of low wind speed databases for short-range modeling applications were provided to EPA by AECOM in a study funded by the American Petroleum Institute (API) and the Utility Air Regulatory Group (UARG). The study was conducted because some of the most restrictive dispersion conditions and the highest model predictions occur under low wind speed conditions, but there had been limited model evaluation for these conditions. The results of the evaluation indicated that in low wind conditions, the friction velocity formulation in AERMET results in under-predictions of this important planetary boundary layer parameter. There were several modeling implications of this under-prediction: mechanical mixing heights that were very low (less than 10 meters), very low effective dilution wind speeds, and very low turbulence in stable conditions. In addition, the evaluation study concluded that the minimum lateral turbulence (as implemented in AERMOD through sigma-v) was too low by at least a factor of 2.

In late 2012, following further review of these issues at the 10th EPA Modeling Conference, EPA made revisions to the AERMOD modeling system to correct the model deficiencies in this area. This culminated in EPA releasing AERMET and AERMOD Version 12345, which included “beta” options in AERMET for a revised u^* formulation under stable conditions and two different low wind speed options in AERMOD. After its release, a bug was found with the “beta” options. The EPA subsequently released AERMET and AERMOD Version 13350 with corrections to this issue and other updates.

Among the changes incorporated into AERMOD 13350 are updates to the AERMET meteorological processor, described in the model change bulletin at

¹ 80 FR 45340, July 29, 2015 Federal Register.

http://www.epa.gov/ttn/scram/7thconf/aermod/aermet_mcb4.txt. One of the changes provides a “bug fix” to the friction velocity (u^*) computation, as stated in the bulletin:
“Modified subroutine UCALST to incorporate AECOM’s recommended corrections to theta-star under the ADJ_U Beta option, based on Qian and Venkatram, that was incorporated in version 12345 of AERMET”.*

EPA presented further (updated) information² in support of the low wind options at the 11th Modeling Conference on August 12, 2015. In their verbal comments³ at the conference, EPA noted for low wind options that much supporting information was provided, and that “We hope to be moving forward with the Clearinghouse action. We’re hoping through that action lowering the bar.”

2. Additional Evaluations for Tall Stacks

In addition to the evaluation information provided by EPA, AECOM has conducted additional testing of the low wind options (ADJ_U* in AERMOD and LOWWIND3 in AERMOD) for tall stack databases. Based upon these tests, we provide in **Attachment A** a general discussion of elements that are part of a request for the use of an alternative modeling approach.

The results of the testing have been published as a peer-reviewed paper in the November 2015 issue of the Journal of the Air & Waste Management Association; this paper is provided in **Attachment B**. The results of supplemental testing of the proposed options in AERMET and AERMOD version 15181 (ADJ_U* and LOWWIND3) with these two tall-stack databases are presented in **Attachment C**. Modeling files associated with these tests have previously been submitted to George Bridgers of EPA’s Office of Air Quality Planning and Standards to accompany comments to the EPA docket for the proposed changes to Appendix W. These comments were made on behalf of two organizations: the American Petroleum Institute and the American Iron and Steel Association.

Attachment A references a modeling report conducted for the Labadie Energy Center that describes the low wind options and other modeling approaches used by AECOM. This report is available as **Attachment D**.

3. Other Applications of the Low Wind Options

Other investigators have applied the low wind options and have submitted their modeling files to reviewing agencies. These submittals have resulted in approvals or pending approvals for the use of these options.

² http://www3.epa.gov/ttn/scram/11thmodconf/presentations/1-5_Proposed_Updates_AERMOD_System.pdf.

³ http://www3.epa.gov/ttn/scram/11thmodconf/presentations/2015_Eleventh_Modeling_Conference-Transcripts_08-12-2015.pdf, page 65.

Eastman Chemical Company, Tennessee

This modeling application was conducted to resolve an SO₂ nonattainment area (for the 1-hour NAAQS). A modeling evaluation study compared the AERMOD modeling approach to AERMOD using, among other refinements, the ADJ_U* option in AERMET and a LOWWIND2 option with a minimum sigma-v of 0.4 m/s (similar to the newly proposed LOWWIND3 option). EPA Region 4 and the Tennessee Department of Environmental Conservation have accepted this modeling approach. The modeling study involved 4 monitors operated for a full year, along with site-specific meteorological data. **Attachment E** is a report that describes the evaluation study and the use of the low wind options (for AERMOD version 14134). **Attachment F** is a letter from EPA Region 4 that approves the use of these low wind options.

Gavin Power Plant, Ohio

This modeling application was conducted for two adjacent large coal-fired power plants in southern Ohio that were identified as priority facilities by the Consent Decree between the EPA and Sierra Club and the Natural Resources Defense Council. This agreement identified areas that contain stationary sources that emitted more than 16,000 tons of SO₂ or emitted more than 2,600 tons of SO₂ and had an emission rate of at least 0.45 lbs SO₂/MMBtu in 2012. 2012. The EPA identified two facilities in Ohio as meeting one or more of these criteria: the General James M. Gavin Plant and the W.H. Zimmer Generating Station.

Ohio EPA conducted a performance evaluation⁴ of the ADJ_U* and the LOWWIND3 options for a monitor in the vicinity of the Gavin plant. Ohio EPA's model performance evaluation demonstrated that AERMOD performance with respect to monitored values in the vicinity of the Gavin plant improves with the ADJ_U* and LOWWIND3 options enabled. These options also resulted in overestimations of the monitored values, indicating that the low wind options will still provide conservative estimates of SO₂ concentrations. Therefore, Ohio EPA relied upon the use of these options in their submittal⁵ to EPA Region 5.

Kentucky has recommended⁶ an attainment status for the Cooper Station, based upon recent modeling⁷ using the ADJ_U* option. The justification for use of this option is similar to that noted below for the EPA Region 10 approval in Alaska. Basically, the low wind options have been available for public review since late 2012, and there are peer-reviewed papers to support their use for tall-stack releases in addition to low-level releases.

4. Other Regulatory Approvals

There has been at least one additional regulatory approval of the ADJ_U* option, which is described below.

⁴ Available at <http://epa.ohio.gov/portals/27/SIP/SO2/C1-Gavin.pdf>.

⁵ http://epa.ohio.gov/portals/27/SIP/SO2/GavinKyq_Desig_Draft.pdf.

⁶ <http://www3.epa.gov/so2designations/round2/R4KYRec.pdf>.

⁷ <http://www3.epa.gov/so2designations/round2/R4KYRecAtt2CooperStationModeling.pdf>.

EPA Region 10 Approval

For general modeling applications in the state of Alaska, and for the Donlin Gold Limited Liability Company (DGLLC) mine construction and operation project in particular, EPA Region 10 has approved the use of the ADJ_U* option as an alternative model (see **Attachment G**). This justification references the EPA presentations² made at the 11th modeling conference as well as in previous presentations⁸.

5. Conclusions

This document provides justification for EPA approval of the ADJ_U* and LOWWIND3 improvements to the AERMOD modeling system that EPA itself has proposed for adoption as default options in AERMOD. In addition to the EPA evaluations, additional evaluations have been conducted:

- A peer-reviewed paper (Paine et al., 2015) and follow-up evaluations with the proposed options indicates improved performance by AERMOD for tall-stack sources, while retaining a modest overprediction tendency.
- A robust evaluation study by Eastman Chemical in Tennessee indicated superior performance with the low wind options, and EPA Region 4 approved these options.
- An evaluation study in Ohio had a similar outcome for the proposed low wind options.

EPA Region 10 has also approved the use of the ADJ_U* option for a project in Alaska.

In light of the evaluations and other approvals for these options, it is clear that these proposed options are appropriate and should be approved for general use in Missouri.

⁸ http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2013/Files/Presentations/Tuesday/104-Brode_AERMOD_System_Update_RSL-Dallas_04-23-2013.pdf.